# Progress with 100 mm Diameter $In_{.53}Ga_{.47}As/InP$ Wafer Processing

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# WHY 100 mm InGaAs/InP?

- Who Needs It??
- For What??

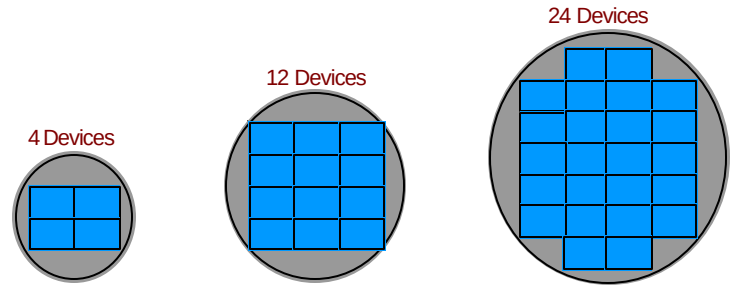
## WHY 100 mm InGaAs/InP

- Near-Infrared Imaging: >$1B
  - chip size is 13x18 mm
- Wavelength Division Multiplexing: >$1B
  - chip size is 6x15 mm
- 6x Cost Reduction from 50 mm

## Why 100 mm (4 inch) InP?

- Save Money
- Increase Yield
- Enable New Products
- Motivated by NIST-ATP Program
- Synergistic with USAF Title III Program

# Effect of Wafer Size on Cost

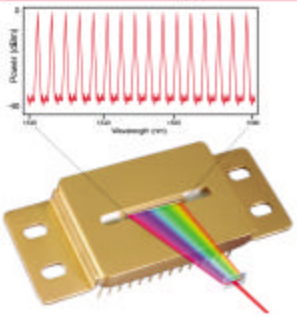



**50 mm Wafer**
**($2500/chip)**

**75 mm Wafer**
**($1000/chip)**

**100 mm Wafer**
**($400/chip)**

## Can you afford NOT to monitor your DWDM system?



Sensors Unlimited's high performance InGaAs arrays offer FAST, RELIABLE, and STABLE measuring capabilities. Easily integrated into your instrument. The monitoring system can offer:

- No moving parts
- Faster signal readout and higher reliability
- 8 to 80 channels (200 GHz to 50 GHz spacing
- ± 0.5 dB Power Accuracy


Renoir's Luncheon of the Boating Party; courtesy of the Phillips Collection, Washington, DC

# Sensors Unlimited, Inc.

World leaders in InGaAs detector arrays, imaging cameras & NIR laser diodes

CAMERAS!

DIODE LASERS!

PHOTODETECTOR ARRAYS!

# Camouflage Under Low Light Level Illumination

Visible CCD

InGaAs FPA @ 10°C

Threshold for detection ≈6 mLux
(bright starlight)

# Transportation / Ice Detection

- Air and Car Transportation
- Significant Positive Impact on Safety
- Over 10,000 Airports
- Over 1,000,000 Bridges and Roadways
- In Year 2000, SUI Sales Projections = .02% of Airports and Bridges

# Ice on Aircraft Wings

# Other Focal Plane Array Programs

- DARPA-Microcamera


- Miniature camera for robotics applications
- < 200 gm (goal 120 gm)
- Built-in 1.55 µm laser designator

## GOALS

- Demonstrate a 100 mm diameter InGaAs/InP manufacturing process
  - good quality substrates
  - uniform epitaxy
  - process tools
  - >50% yield of camera chips

## Conclusions (as of Nov, 1999)

- **GOOD** quality 100 mm S-InP substrates
- **GOOD** quality InGaAs/InP photodiodes on 75 mm S-doped substrates
- "Spin-On" zinc diffusion works
- We expect the program to **SUCCEED**

# Summary of Results
# InGaAs/InP Photodiode Arrays

| | RoA (ohm-cm$^2$) |
|---|---|
| Best OMVPE | 1,000,000 |
| Typical OMVPE | 80,000 |
| | |
| MBE (75 mm wafer) | 30,000 |
| OMVPE (75 mm wafer) | 200,000 |
| Spin-On Diffusion | 200,000 |